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F45 - FTN4 to FTN5 CONVERSION AID REFERENCE GUIDE

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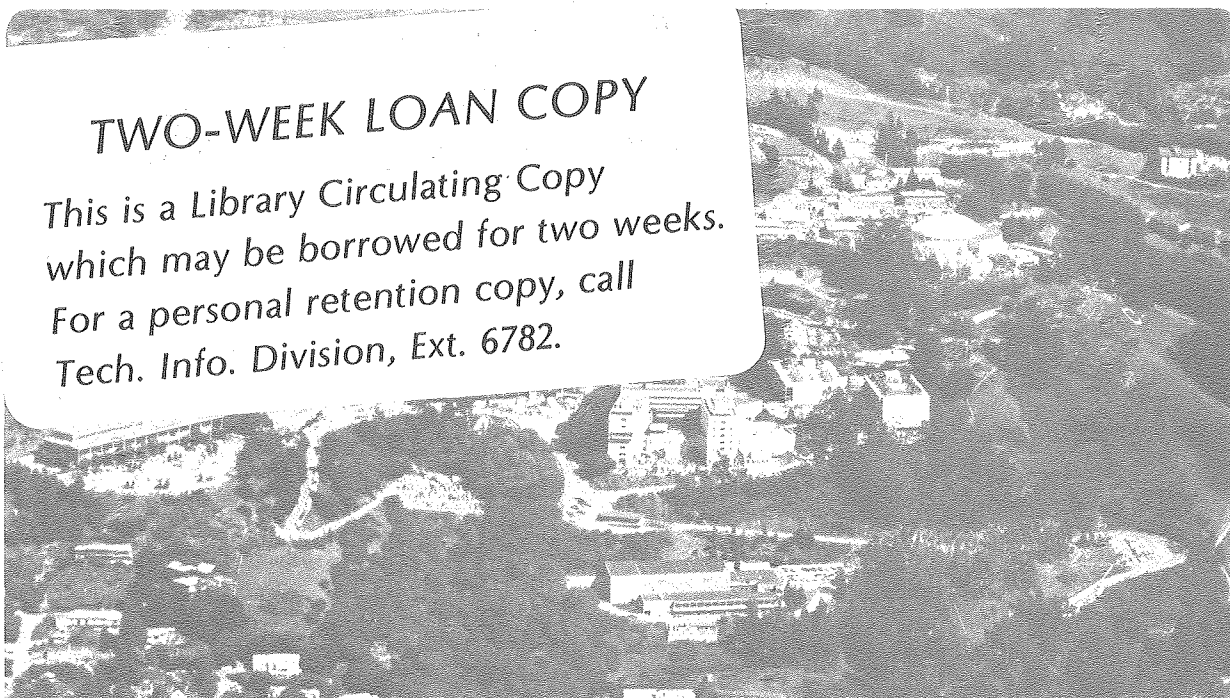
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BKY Programming Systems Bulletin #2

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F45
FTN4 to FTN5 Conversion Aid
Reference Guide*

INTRODUCTION

The FORTRAN Extended (FTN) Version 4 to FORTRAN Version 5 (FTN5) Conversion Aid Program (F45) is designed to produce translations that conform as closely as possible to FTN5. FTN5 is based on the ANSI FORTRAN 77 language. Some of the major differences in FORTRAN 77 include IF-THEN-ELSE constructs, the PARAMETER statement, and CHARACTER data. To make programs more portable, the standard now incorporates such extensions as PRINT, ENTRY, and alternate return.

FTN5 includes the complete FORTRAN 77 standard, but has additional special features. The FTN5 compiler can, as an option, flag any nonstandard statement. Obsolete or little-used features have not been included in FTN5. A few features have changed functionally, but not syntactically. These include the computed GOTO and the DO loop. The C\$ DEBUG package has been discontinued.

Over 50 differences exist between FTN4 and FTN5, but most of these differences can be automatically converted with little or no manual effort. The conversion program flags any statements it cannot convert.

F45 can produce as its output an entire converted program, or it can generate the UPDATE or MODIFY directives necessary to convert a program stored in program library format.

F45 converts only valid FTN4 statements as described in the FTN4 Reference

* LBL wishes to acknowledge that Control Data Corporation is the author of a major portion of this Bulletin, which is edited from CDC manual 60483000, Rev. A, "F45 Reference Manual".

Manual, and does not convert undocumented features. Programs depending on a particular FTN4 implementation might not produce the same results after conversion.

F45 does not perform extensive syntax analysis. Since its purpose is to detect language differences, it might ignore certain syntax errors. Input to the conversion program should consist only of programs that have compiled and executed correctly under FTN4.

For a detailed discussion of the automatic FTN4 to FTN5 conversion made by F45, as well as those marked by F45 for manual conversion, see BKY Programming Systems Bulletin #1, "Guidelines for Converting FTN4 Programs to FTN5 and the New FORTRAN-77 Standard"

1. F45 CONVERSION AID OPERATION

F45 reads a FTN4 program from an input file and produces a listing file and a source file of converted FORTRAN statements. The contents of these output files are controlled with F45 control card parameters.

1.1. INPUT TO F45

F45 reads a single input file. The I= parameter is used to specify the input file name. The file can have more than one program unit; F45 recognizes the end of one program unit and the beginning of another.

The input file can be one of two formats: standard, or COMPILE. Standard format consists of statements coded in columns 7 through 72, with statement labels in columns 1 through 5; any information can be in columns 73 through 80. COMPILE format is the 90-column UPDATE or MODIFY format.

STANDARD INPUT

Standard input usually consists of a complete FTN4 program. F45 will by default write on the P= file only those lines that have been changed. The user will usually find it more practical to select PO=F (write the whole program) with standard input.

COMPILE INPUT

F45 can read a COMPILE file and produce an output file that can be used to update the old program library from which the COMPILE file was generated. When the PO=M parameter is selected and the input is a COMPILE file, F45 generates an UPDATE/MODIFY directive for each statement that needs to be translated. The

directive is a command to delete the original statement and insert the translated statement.

For a statement requiring a manual change, the original statement is listed as a replacement line, but is not translated. F45 generates a directive to delete the original statement and to replace it with the same untranslated statement. The user must then manually change this statement.

F45 generates, in most cases, a directive for each change. MODIFY users should note that, because it is impossible to determine the deck names from the COMPILE file, *DECK directives are not generated; MODIFY users must generate these directives.

Common Deck Directives

A user can use special F45 directives to update a source program library containing common decks. Without these directives, every time a common deck appears in a COMPILE file, F45 translates the common deck and provides directives to update the old program library. If a common deck appears more than once, F45 generates duplicate directives. The duplicate directives will produce errors during an update of the old program library.

The special directives have the characters C\$ in columns 1 and 2, and a keyword beginning in column 7. The three keywords are BEGCOM, ENDCOM, and LIST. BEGCOM and ENDCOM should be inserted at the beginning and end of a common deck. The LIST directive is then used in the calling deck. If LIST is omitted, or if LIST(C=0) is specified, the lines between BEGCOM and ENDCOM are not converted. If LIST(C) or LIST(C=1) appears, the lines are converted only once. LIST must precede the first occurrence of the common deck on the COMPILE file.

1.2. OUTPUT FROM F45

F45 produces two output files: a listing and a source output file. The listing (controlled by the L= and LO= control card parameters) is formatted for printing; a line has a maximum of 137 characters, including a carriage control character in column 1. The source output file (controlled by the P= and PO= control card parameters) is formatted into 80-column lines. The output lines retain the original format as much as possible. Statements that are correct for FTN5 remain unchanged. When a statement must be changed, leading and embedded blanks are retained. If an item in a statement is deleted, the blanks following are also deleted. If a statement is added, it begins in column 7 and ends in column 72. If a statement must be continued, it is broken at a delimiter and continued on the next line, beginning in column 7.

Wherever possible, comments embedded between continuation lines are retained in FTN4 statements. If the original FTN4 statements are totally restructured so that these comments have questionable value, the comments are repositioned in front of the original statements. Comments between statements remain in their

original positions.

F45 generates a comment header for each program unit. The header appears in both the listing and the source output file. The header information states which version of the F45 converted the program units and the version of FTN5 for which the converted programs are valid.

LISTING FILE (L= file)

The user can select one of four output formats for the listing, or can suppress the listing altogether. One of the choices, the full listing, includes a copy of the input file. The other formats include only statements changed or added by F45 and statements requiring manual action.

In the listing, a source statement is followed by any F45 messages applying to it. The messages are of three types: automatic conversion, manual action, and error diagnostics. The messages are described in section 2.4.

For each action that F45 takes, it prints a symbol at the end of the input line to indicate what the action was. The meanings for the three symbols are:

- I- Statement inserted.
- R- Statement replaced previous statement.
- D- Statement deleted.

F45 writes a message summary at the end of each program unit.

Full Listing LO=F

The full listing has two parts. The first part is a copy of the input file. The second part is in one of two formats, depending on the input. If the input is a COMPILE file, the second part is exactly the same as the UPDATE/MODIFY listing. If the input file contains standard lines, the second part contains:

- Unchanged lines
- Changed and added lines
- Lines requiring manual action
- Error diagnostics
- A statistical summary of F45 processing

Short Listing LO=S

The short listing is like the second part of the complete listing, except that the unchanged statements are not included. The output contains:

Changed and added lines

Lines requiring manual action

Error diagnostics

A statistical summary of F45 processing

UPDATE/MODIFY directives are not listed, even if the input is a COMPILE file.

Error Listing LO=E

The error listing contains:

Statement lines requiring manual action

Error diagnostics

UPDATE/MODIFY directives are not listed, even if the input is a COMPILE file.

Modification Listing LO=M

The modification listing is exactly the same as the second part of the full listing, except that UPDATE/MODIFY directives precede the statements. This format of the listing is used only when the input is a COMPILE file. The modification listing contains:

Changed and added lines

Lines requiring manual action

Error diagnostics

A statistical summary of F45 processing

Note that if the user ignores lines requiring manual action, the lines are deleted and reinserted, so that there is no net change. If the user wishes to change the line, the replacement line can be used as a template to create a new line.

SOURCE OUTPUT FILE (P= file)

The user can select one of three formats for the source output file, or can suppress creation of the file. The source output file does not include any F45 messages except for the comment header.

Full Source Output File PO=F

The full source output file is generated when input is a standard file. This output ready for compilation under FTN5 except for any statements requiring manual inspection or action. The full file contains:

Comment header generated by F45

All unchanged lines

Changed lines

Added lines

Lines requiring manual action or inspection

If the input file is a COMPILE file, PO=F is equivalent to PO=M.

Short Source Output File PO=S

The short source output file consists only of changed statements rather than complete program units. The short source output file is used for manually updating FTN4 source programs and contains:

Changed lines

Added lines

Lines requiring manual action or inspection

Modification Source Output File PO=M

The modification source output file is generated when the input is a COMPILE file. If the input file is in standard format and a modification source output file is requested, the F45 generates a message but no output. The output is intended for an UPDATE/MODIFY program library and contains directives.

Because it is impossible to determine the DECK names from COMPILE file output, the MODIFY user must insert the necessary DECK directives.

COMPASS SUBROUTINES

COMPASS subroutines appear in the output without change. If LO=F is selected, COMPASS subroutines are written to the listing. If PO=F is selected, COMPASS subroutines are written to the source output file.

1.3. F45 CONTROL STATEMENT

F45 is called with a control statement that conforms to operating system syntax; the statement cannot be continued on another line. The control statement takes one of the following three forms:

F45.

F45, p1, p2,...,pn.

F45(p1, p2,..., pu)

The optional parameters, pi, can be in any order.

A variety of options can be specified in the parameter list. No parameter can be used more than once. For any omitted parameters, default values are supplied. Specific default values are given with the description of each parameter. An invalid or duplicated parameter causes the job to skip past a CXIT card. Comments can follow the terminating right parenthesis or period.

More than one program can be converted by a single F45 call. When several programs are to be converted, the programs should follow each other without separation. F45 recognizes the end of each program unit.

In the following parameter descriptions, lfn denotes a file name, which is one through seven letters and digits beginning with a letter

CC-COMMENT CONTROL

FTN4 recognizes a statement with a \$ in column 1 as a comment; FTN5 does not. F45 changes the \$ to a C or an *, as specified by the CC parameter. The options are:

omitted

Change \$ indicating a comment line to C.

CC

Same as omitted.

CC=C

Same as omitted.

CC=*

Change \$ indicating a comment line to *.

CI-CORRECTION IDENTIFIER FOR UPDATE/MODIFY

The CI parameter specifies an update/modify correction identifier for a run with a COMPILE file as input. Unless at least one of the options LO=M, LO=F, PO=M, or PO=F is specified, the CI parameter is ignored. The options are:

omitted

Generate an UPDATE/MODIFY directive of the form:

*IDENT dddhhmm

The ddd is the number of the day of the year. The hh is the hour of the day and mm is the minutes.

CI

Same as omitted.

CI=0

Do not generate an *IDENT directive, even if LO=M, LO=F, PO=M, or PO=F is specified.

CI=idname

Generate an UPDATE/MODIFY directive of the form:

*IDENT idname

The idname is the correction identifier to be assigned to this set, and must be seven or less letters and/or digits.

DD - DELETE C\$ DIRECTIVES

Both FTN4 and FTN5 provide compiler directives that begin with a C\$ in columns 1 and 2. FTN5 does not recognize the FTN4 directives; the FTN4 directives would produce an error under FTN5. The F45 converts the FTN4 directives as specified by the DD parameter. The options are:

omitted

Delete all statements with a C\$ in columns 1 and 2.

DD

Same as omitted.

DD=0

Convert statements with a C\$ in columns 1 and 2 to comments by replacing the \$ with a blank.

ET - EXIT TERMINATION

The ET parameter specifies exit termination activity. The options are:

omitted

Terminate normally, no matter what conditions exist in the input file.

ET

Terminate normally only if none of the following conditions exist: FORTRAN syntax errors, statements requiring manual action (not just inspection), or requests for UPDATE/MODIFY output files when input is not a COMPILE file. F45 skips past a CXIT card if any of these conditions exist.

ET=0

Same as omitted.

I - SOURCE INPUT FILE

The I parameter specifies the source input file. The options are:

omitted

Same as I=INPUT.

I

Same as I=COMPILE.

I=1fn

Read source programs from the file named lfn.

L - LISTING FILE

The L parameter specifies the listing file. The options are:

omitted

Same L=OUTPUT.

L

Same as L=OUTPUT.

L=0

Do not produce listing.

L=lfn

Write listing on the file named
lfn.

LO - LISTING OPTIONS

The LO parameter specifies listing options. The options are:

omitted

Produce a short listing containing:

Translated and added lines

Lines requiring manual action

F45 messages and error diagnostics

UPDATE/MODIFY directives are not listed, even if the input is a COM-
PILE file.

LO

Produce a full listing with two parts: a verbatim copy of the input file, and a listing that depends on the type of input. The first part of the listing is always produced. If the input file is standard, the second part of the listing contains:

Lines that require no change

Changed and added lines with the related F45 message

Lines requiring manual action with the related f45 message

Messages and error diagnostics

If input is a COMPILE file, the second part of the listing contains:

Generated UPDATE/MODIFY directives

Translated and added lines with the related F45 message

Lines requiring manual action with the related F45 messages

Messages and error diagnostics

LO=S

Same as omitted.

LO=F

Same as LO.

LO=E

Produce an error listing containing:

Lines requiring manual action and related F45 messages

Error diagnostics

Note that F45 does not list Updat/MODIFY directives, even if input is a COMPILE file.

LO=M

Produce a modification listing containing:

Generated UPDATE/MODIFY directives

Translated and added lines

Lines requiring manual action

Messages and error diagnostics.

LO=M is meaningful only if the input is a COMPILE file.

MC - MASTER CONTROL CHARACTER

Specifies the master control character to be used when generating UPDATE or MODIFY directives. Default is *. If the master control character to be specified is one of the following:

\$ + - / =

it must be specified within square brackets.

Omitted The master control character is *.

MC Same as omitted.

MC=c The master control character is c.

MD - MACHINE-DEPENDENT USAGES

The MD parameter specifies machine-dependent usages. The options are:

omitted

Ignore the machine-dependent constructs.

MD

Issue a manual change message for each statement that contains at least one machine-dependent construct. F45 recognizes the following machine-dependent constructs:

Hollerith data

Shifts and masks

Intrinsic functions dealing with bit manipulation: XOR, OR, AND, COMPL, and LOCF

Octal and hexadecimal data

ENCODE and DECODE statements

BUFFER IN and BUFR OUT statements

If the MD parameter is specified, F45 flags statements containing these constructs, warning the programmer that they might have to be changed if the program is ever transferred to another computer.

P - SOURCE OUTPUT FILE

The P parameter specifies the source output file. The options are:

omitted

Do not produce any source output.

P

Write source output on the file named PUNCH (not recommended - it will be automatically queued to the card punch at BKY).

P=0

Same as omitted.

P=1fn

Write source output on the file named 1fn.

PD - PRINT DENSITY

The PD parameter specifies print density. The options are:

omitted

Produce a listing with a print density of six lines per inch.

PD

Produce a listing with a print density of eight lines per inch

PD=6

Same as omitted

PD=8

Same as PD.

PO - SOURCE OUTPUT OPTIONS

This parameter selects the data to be included on the source output file. If the P parameter is not specified or if P=0 is specified, F45 ignores this parameter and does not produce a source output file.

omitted

Produce a short source output file containing:

Lines requiring manual action

Changed lines

Added lines

The short source output file is intended for manually updating the original source decks. This output is not suited for direct input to the compiler.

PO

Produce a modification file. If the input is standard, F45 issues an error message and produces no output. If the input is a COMPILE file, F45 produces a modification file containing:

UPDATE/MODIFY directives to modify the old program library

Changed lines

Added lines

Lines that require manual action

Except for lines requiring manual action, modification output is suitable for modifying an old program library.

PO=S

Same as omitted.

PO=F

Produce a full source output file. If the input is a COMPILE file, PO=F is equivalent to PO=M. If the input is standard, F45 produces a complete file containing:

Input lines that need no translation

Changed lines

Added lines

Lines that require manual action

Except for lines requiring manual action, this output is suitable
for direct input to the compiler.

PO=M Same as PO.

SUMMARY OF F45 PARAMETERS

A summary of the parameters for the F45 control statement is shown below:

Parameter	Use	First Default (keyword omitted)	Second Default (keyword only)	Notes
CC	Comment Control	CC=C	CC=C	For comments beginning with \$.
CI	Correction Identifier	CI=dddhhmm	CI=dddhhmm	Requires LO=M, LO=F, PO=M, or PO=F
DD	Delete C\$ Directives	DD	DD	Can be DD=0
ET	Exit Termination	ET=0	ET	
I	Source Input File	I=INPUT	I=COMPILE	Can be I=1fn.
L	Listing File	L=OUTPUT	L=OUTPUT	Can be L=1fn or L=0.
LO	Listing Options	LO=S	LO=F	Can be LO=M or LO=E.
MC	Master Control Character	MC=[*]	MC=[*]	Can be MC=[char].
MD	Machine-Dependent Usages	Off	On	Issues manual change messages for the constructs.
P	Source Output File	P=0	P=PUNCH	Can be P=1fn.
PD	Print Density	PD=6	PD=8	Applies to listing.
PO	Source Output Options	PO=S	PO=M	Can be PO=F

2. F45 MESSAGES AND DIAGNOSTICS

F45 produces a series of messages and diagnostics. Most of the messages are informative. Some messages flag potentially troublesome statements; the user is not obligated to change the flagged statements, but if the changes are not made, the program might execute incorrectly. The error messages (diagnostics) usually require some user action.

The format for the messages is:

```
***Tnn***message
```

where T is the type of messages: A for automatic conversion, M for manual change required, and E for error; nn is the message number; and message is the actual message.

The A type message for automatic conversion is generated whenever the conversion program adds, deletes, or replaces a statement. These messages are informative and require no manual action, and are self-explanatory.

The M type message for manual change is generated whenever the conversion program encounters a statement that it cannot translate properly or a statement that might not compile or execute correctly. Often the message is a warning to the user; the statement might be correct, but the user must decide. Some messages indicate flagged statements that must be changed. The manual action messages, their meanings, and what actions to take are listed in below.

The E type message for error is generated whenever the conversion program encounters an error such as a syntax error or an invalid input file. If the conversion program generates any manual action message, it also generates an error message; this error message is not fatal.

MANUAL CHANGE MESSAGES

<u>Number</u>	<u>Message</u>	<u>Action</u>
M01	POSSIBLE EXTENDED RANGE DO	Check range of DO statement.
M02	DO PARAMETER REDEFINED WITHIN RANGE OF DO	Make sure number of times DO loop inexecuted is not affected.
M03	FUNCTIONS -SLITE- AND -SLITET- NOT SUPPORTED IN FTN5	Replace function with logical variable.
M04	-DATE, JDATE, TIME, CLOCK, SECOND- HAVE NO ARGUMENTS IN FTN5	Rewrite statements that depend on argument.
M05	SYNTAX ERROR IN TWO BRANCH ARITHMETIC IF STATEMENT	Correct IF Statement
M06	SIMPLE VARIABLE USED AS FORMAT SPECIFIER IN I/O STATEMENT	Eliminate simple variable.
M07	V DESCRIPTOR USED IN FORMAT STATEMENT	Eliminate V edit descriptor.
M08	= DESCRIPTOR USED IN FORMAT STATEMENT	Eliminate = edit descriptor.
M09	FORMAT CONTAINING HOLLERITH DESCRIPTOR USED BY INPUT STATEMENT	Use character data instead.
M10	NEGATIVE HOLLERITH CONSTANT LARGER THAN 50 CHARS IN DATA STATEMENT	Rework Hollerith constant
M11	FTN4 INTRINSIC FUNCTION USED AS ACTUAL ARGUMENT	Check function name. Some intrinsic functions not allowed as actual arguments in FTN5.
M12	TYPE ECS CONVERTED TO LEVEL 3.	Check conversion.

CHECK CONVERSION

M13	HOLLERITH PARAMETERS - CHECK DEPENDENCY ON TRAILING ZEROS	Check Dependency.
M14	TYPE MISMATCH	Change type.
M15	IF EXPRESSION NOT TYPED LOGICAL OR NOT ARITHMETIC IF	Check validity of IF statement.
M16	SECOND PARAMETER OF READEC NOT IN LEVEL OR IS NUMERIC VALUE	Check READEC.
M17	READEC/WRITEC WITHOUT ECS OR LEVEL STATEMENT - NOT CONVERTED	Check statement.
M18	CHECK USAGE OF ASF (Arithmetic statement function is incorrect. Syntax is incor- rect or use of dummy arguments is not correct for FTN5)	Check statement, and all references.
M19	DUMMY ARGUMENT REFERENCE MUST BE SIMPLE VARIABLE	Change dummy argument to a simple variable.
M20	NO CONVERSION OF COMPLEX TO REAL - REAL USED AS VARIABLE	Check conversion
M21	FUNCTION IOCHEC ... MANUAL INS- PECTION REQUIRED	Check IOCHEC function usage.
M22	LIST(C=0) IGNORED DUE TO NEW SOURCE - CHECK UPDATE/MODIFY DIRECTIVE CONFLICTS	Check conversion
M23	MACHINE DEPENDENT CODING IN ABOVE STATEMENT	Check the machine- dependent coding
M24	SUBSCRIPT OF ARRAY EXCEEDS DIMENSION	Change subscript.
M25	PARTIAL LIST DIRECTED READ TREATED DIFFERENT BY FTN5	Check input to list- directed READ for possible skipping of input values.

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